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MOSAIC DISEASES OF VEGETABLE PLANTS

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Virus diseases of plants include a large number of plant troubles which can be quite distinctly separated from those caused by visible parasites and from the so-called physiological diseases resulting principally from certain environmental factors. A peculiar feature of virus diseases is that they are contagious. The infectious principle, the exact nature of which is unknown, is carried in the sap of diseased plants.

Mosaic—a name applied to certain designs and patterns in applied art in ancient times—is used in plant pathology to describe certain virus diseases of plants characterized by the mottled appearance of the foliage, forming a mosaic-like pattern of dark green and paler yellowish-green of various sizes on the leaves. This disease has been observed in every section of Florida. In southern Florida and in other parts protected from freezing temperatures, diseased plants live from year to year. In northern Florida frost kills the aboveground parts of certain diseased plants, but the underground parts continue to live and in spring new shoots are produced that show mosaic. This is true of pokeweed, ground cherry and certain solanaceous plants.

The disease affects vegetable crop plants and weeds belonging to a number of different families, including pokeweed, pigweed, beet, ragweed, turnip, bean, eggplant, cucumber, squash, ground cherry, spinach, celery, watermelon, romaine, endive, potato, pepper, escarole, milkweed and lettuce. In a single family, such as the Solanaceae, it has been found on plants from every genus, namely, ground cherry, apple of Peru, tomato, eggplant, potato, tobacco, pepper, jimson weed, petunia, jasmine, box-thorn and belladonna.

Mosaic is very important on cultivated plants such as squash, pepper, tomato, lettuce and celery, where 100 percent infected plants resulting in 50 percent or more loss in yield have been observed. It has been found doing some damage in almost every field or garden visited.

Symptoms:—Mosaic plants may show the disease by mottling of foliage, malformation of aerial parts and stunting. The leaf blades show irregular light and dark green patches. They may be curled, rolled, cupped or puckered, undersized and ill-shaped. The mottling is not conspicuous on lettuce and requires experience to detect it. High temperatures often cause the mottling to disappear or become inconspicuous. Sometimes the disease man-

ifests itself on tomatoes by the formation of long, slender leaves consisting principally of the midrib and has been called "fern-leaf." Leaves of cucumber plants may show some mottling but, in addition, they are more deeply notched and more pointed. Diseased pepper plants show a number of irregular types of leaf formation and variations in mottling. Mosaic may cause a dwarfing of flowers or parts of them. In addition, they may be mottled, malformed and distorted into various abnormal forms or shed prematurely.

In most cases mosaic plants show more or less stunting or dwarfing of the stems and fruit. The fruits are often less than half the size of those on normal plants. Mottling of cucumber, squash, pepper and tomato fruits are common on diseased plants. The mosaic pattern is similar to that on the leaves and, in addition, the surface of them is usually more or less irregular, because of raised and depressed areas. Squashes, both green and yellow varieties, are often conspicuously bumpy and green and yellow mottled. Cucumbers are smoother, but at the same time characteristically mottled. Peppers and tomatoes are rather smooth, usually faintly mottled and decidedly stunted in size. The stems of mosaic plants show two typical symptoms of the disease, namely, mottling and stunting. The stunting of the stem is one of the principal symptoms of the disease. The sections (internodes) between leaf scars (nodes) are decidedly shortened, which results in dwarfed plants that appear more leafy because the leaves are closer together along the stem. Often this is so definite that the plants appear to be rosetted.

The exact cause of mosaic is not definitely known. However, there are a number of facts known about the disease that suggest methods for control. The disease is maintained from season to season in several different ways. Seed of bean and wild cucumber are known to harbor the causal agent of the disease.

Dissemination:—The spread of the disease during any single season is accomplished by various means, such as the planting of diseased bean seed, by the planting of potato and sugarcane seed pieces that are diseased and by the alternate handling of diseased and healthy plants during cultural operations, such as hand weeding of seedbeds, pruning of tomatoes, tying up of cucumbers and staking tomatoes and the harvest of certain products, such as cucumbers and tomatoes, where successive pickings are made.

It is also spread among cultivated plants by certain insects. An aphid or jassid may feed on a mosaic celery plant and then fly or be moved by other means to a nearby healthy plant and feed. When such insects feed on healthy plants, the virus is introduced into their cell sap, thus infecting the plant, which results later in the appearance of the disease and its spread from plant to plant. This mode of infection is more certain than the transfer of plant juices on pruning knives or hands of workers tying cucumber plants or picking tomatoes. This also explains how the disease may be carried from a mosaic pokeweed along a fencerow or ditchbank to pepper or tomato plants in a field, or from a mosaic pepper plant to a potato or cucumber plant. Cucumber plants, for instance, may develop mosaic when juice is injected into them from mosaic plants of different kinds, such as potato, tomato, pepper, cantaloupe, ground cherry, tobacco, horseweed, catnip, pokeweed, milkweed and pigweed. The spread of the disease between plants of different kinds goes on to almost indefinite numbers. Insect transmission is probably the most important type of dissemination.

Control:—Control of mosaic naturally falls into four distinct methods or operations based on its nature and agencies of transmission. These are: (1) control of insects responsible for the transmission of sap or plant juices from mosaic plants, wild or cultivated, to healthy plants; (2) destruction of weeds and crop plants that are diseased and act as sources of inoculum throughout the growing season; (3) removal by roguing of diseased plants in fields as soon as the symptoms of the disease are observed and (4) sanitary practices, such as precautions taken in handling plants in all kinds of horticultural operations, as pruning, tying and handling of plants at picking time.